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ABSTRACT

Two mediated approaches to individualized instruction--computer-assisted (PLATO) and individualized booklet--were compared in terms of their effect on student achievement. Computer-assisted instruction offers potentially sophisticated use of individualized instruction techniques (e.g., random selection of items, sequencing, and answer judging, but the booklet has a potential advantage in its portability and relative low cost of production. Forty-three inner city social science students, assumed to be homogeneous in intelligence and age, were divided into two groups. After suitable introduction to their respective methods, the students were given a week to complete a study unit. Using the t-test for independent samples on the data from the post-test scores, the null hypothesis that there will be no significant difference in the mean achievement scores between the two groups could not be rejected by the results of the .05 level of significance, although there was a slight difference in favor of the PLATO method. Although both groups enjoyed the instruction, there was a significant difference between the mean attitudinal scores favoring PLATO. A short bibliography is appended. (Author/MJK)

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# A Comparison of the Achievement Results on a Social Science Unit by Kennedy-King College Students Instructed by Computer with those Instructed by Individualized Booklet

by

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A PRACTICUM PRESENTED TO NOVA UNIVERSITY
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ABSTRACT

Kennedy-King College, one of the City Colleges of Chicago, is comprised primarily of inner-city students who have had difficulties learning by traditional instruction. New modes of instruction, particularly individualized instruction may be better suited to enhance learning by such students. Two mediated approaches to individualized presentation--individualized booklet and computer-assisted instruction--were compared in terms of their effect on student achievement. Students in two Social Science 102 classes were randomly selected into two groups (Group A: individualized booklet and Group B: PLATO) and received individualized instruction on "The Ideological Spectrum." Forty-three students completed the posttest (Group A mean = 71, median = 79; Group B mean = 79.5, median = 81).

Although the null hypothesis that "there will be no significant difference in the mean achievement scores between students who have been instructed by individualized booklet and those who have been instructed by computer" could not be rejected by the results at the .05 level of significance, there was a slight difference favoring PLATO (p=0.1432).

An auxilliary finding was that although both groups of students enjoyed the instruction (Group A mean = 3.688, Group B mean = 4.739 on a 5-point scale with 5 being the best score), there was a significant difference between the mean attitudinal scores favoring PLATO (p=0.0001).

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## A Comparison of the Achievement Results on a Social Science Unit by Kennedy-King College Students Instructed by Computer with Those Instructed by Individualized Booklet

### I. Statement of the Problem

Many inner-city students come to the community college under-prepared. Most of these students perform as poorly under traditional instruction in the community college as they had performed in the public school. Kennedy-King College, an urban community college in Chicago that is comprised of inner-city students, must contend with this problem.

New modes of instruction, particularly individualized instruction, may be better suited to enhance learning by such students. Two mediated approaches to individualized presentation--computer-assisted instruction and individualized booklet--will be compared in terms of their effect on student achievement.

### II. Hypotheses

Null hypothesis: There will be no significant

difference in the mean achievement scores between students who have been instructed by individualized booklet and those instructed by computer.

Alternative hypothesis: there will be a significant difference in the mean achievement scores between students who have been instructed by individualized booklet and those who have been instructed by computer.

## III. Background and Significance

### A. Individualized Instruction: Characteristics

Most inner-city students have difficulty learning because they have been inadequately prepared for college. They lack the basic reading, writing, listening, speaking, and math skills necessary to give them a good foundation on which to learn more complex skills and concepts. Lecture, the prevalent mode of instruction used in colleges, is particularly unsuited to inner-city students because they have difficulty taking notes and knowing what is worth remembering.

Individualized instruction--self-contained, self-instructional packages (Russell, 1974, p. 13)--may be better suited to the learning styles of inner-city students.

There are numerous advantages to using individualized instruction. Such instruction shows more concern for

individual differences because it allows the student to work at his own pace; the slow learner has more time to complete the instruction; also, in many cases, the student has some freedom to decide how he will proceed through the instruction and which activities to pursue.

Individualized instruction usually provides the student with the objectives of the lesson so that he knows what he is to learn. The presentation of objectives enhances learning (Edling, 1972).

Individualized instruction provides for the active involvement of the student in the learning process by requiring him to respond frequently to the instruction. Such involvement enhances learning (Hilgard, 1966, pp. 541-584).

Individualized instruction provides the student with immediate reinforcement. The student is informed when he makes a mistake, as well as when he is correct. Such reinforcement enhances learning (Skinner, 1958, pp. 94-99).

Individualized instruction provides mastery learning (Bloom, 1971, pp. 47-62) in which the student is not allowed to advance to more difficult portions of the instruction until he has demonstrated proficiency.

Individualized instruction provides the learner with a particular sequence of material built on learning principles such as association and learning with understanding (Hilgard, 1966, p. 563).

Individualized instruction can use a variety of media. Individualized booklet, computer, TV, slide-tapes, filmstrips, and motion pictures are just a few of the many different modes of instruction available.

Individualized instruction can formatively and summatively evaluate student performance and in turn be evaluated for its success or failure to teach. The instruction can be revised on the basis of student testing.

Individualized instruction uses criterion-referenced testing as opposed to norm-referenced testing. In other words, students are not evaluated in terms of how they perform in comparison to their classmates. Criterion-referenced tests provide information on specified performance standards established prior to test construction. The tasks to be performed on the test are representative samples of the tasks that are the objectives of the instruction (Glaser, 1971, p. 654).

B. Individualized Instruction: History

Individualized instruction as a systematic approach to instruction was used in 1935 by Ralph Tyler who conceptualized the application of specific behavioral objectives to instruction and testing (Herrscher, 1971, p. 4).

Individualized instruction came into prominence in the 1950's when programmed instruction gained popularity.

Programmed instruction used small-step learning in which the student would be given a bit of instruction and then asked to respond to a question that would determine if he understood the instruction. Skinner's article on "Teaching Machines," published in Scientific American in 1961, discussed three principles which linear programs followed: active participation, knowledge of results and minimal errors (good instruction supposedly demanded a design which ensured minimal error on the part of the student) (Markle, 1969, pp. 2-25).

Branching programs, first designed by Crowder, came into prominence a few years after linear programming. Branching programs presented much more information at each step of instruction (two or three paragraphs as opposed to sentences). The method of student response was usually multiple-choice as opposed to constructed response. Each response was keyed to a different page or frame of material in the program. If the student made a mistake, he was referred to another page which would explain why he had been incorrect and then sent back to the original question, given a similar question or provided a new strategy (Pipe, 1966, p. 12).

Programmed instruction compelled the lesson designer to think carefully about the organization, structure, and sequence of instruction. Unlike textbooks, which tended

to be reference-oriented, programmed instruction was teaching-oriented. In many cases it fostered relevant instruction because it forced the lesson designer to face up to the issues involved (Pipe, pp. 1-6).

Programmed instruction declined in popularity during the 1960's with the rise of audio-tutorial instruction and individualized learning modules which applied a more inclusive systematic design.

C. Individualized Booklet and PLATO

The individualized booklet applies some of the features of programmed instruction such as knowledge of results and active-learner involvement, but it is more eclectic in its design and uses both student-constructed responses and multiple-choice items. It applies a systematic approach to instruction that has at a minimum behavioral objectives, diagnostic feedback, learning activities, and posttest.

PLATO is the highly sophisticated computer-assisted instruction (CAI) system developed at the University of Illinois in Urbana during the 1960's (CERL, c. 1973).

The standard PLATO IV student terminal consists of a TV-like screen which displays the instructional material, the student's responses, and the computer's responses; and a keyset which is similar to an ordinary typewriter but which has extra special-function keys and which allows

the student to enter responses, transmitting these to the central computer at the Urbana campus.

PLATO is similar to other programmed instruction in that it allows each student to work at his own pace and in that it can give appropriate feedback based on the student's performance. PLATO is much more versatile and precise. The student who demonstrates he needs minimal instruction in one area can be directed to new and more difficult material, while the student who needs more assistance can be presented with as much detailed help and review as is deemed necessary. Because PLATO follows the rules set forth by the lesson designer, it can be made to handle nearly every kind of student response. PLATO can be effective with positive reinforcement. The student can receive comments such as "Good work" and "Fantastic;" the student also can be called by the name he wants PLATO to address him, such as "Good work, Mr. Jones."

PLATO can keep very precise and objective records of all student responses and make such data or a summary of such data available to the instructor. Because of its computational ability, PLATO can be made to give endless drill and practice according to the individual student's performance.

Computer-assisted instruction is inherently different

from individualized booklet in terms of the medium itself (TV screen and keyset v. paper and pencil) and in terms of the potentially sophisticated use of individualized instruction techniques (e.g. random selection of items, sequencing, and answer judging). The individualized booklet has a potential advantage in that it is portable--students can use it anywhere, anytime. It is also less expensive to produce and use. The objective of this experiment was to determine which of these two mediums is the more effective teacher of "drill and practice" learning material for inner-city students at Kennedy-King College.

D. Kennedy-King College

Kennedy-King College, one of the City Colleges of Chicago, enrolls over 10,000 students, most of whom live in the Englewood area of Chicago, a poverty-stricken neighborhood on Chicago's South Side.

The composite Kennedy-King student is a black female over 21 who ranked in the lower portion of the second quarter of her high school graduating class. She lives four miles from the College, majors in business or social service, plans to attend a four-year college, and lives in a family that earns just over $7500 annually (City Colleges of Chicago, 1973).

Reading skills among Kennedy-King students range from the second to the twelfth grade-level. Many students

have difficulty reading class assignments and understanding the academic language used by the faculty.

Kennedy-King has served about 9,000 inner-city residents each semester for the past three academic years, yet less than 400 students have graduated each of these years.

IV. Definition of Terms

1. Inner-city students: students who live in those parts of the city characterized by low family income (less than $10,000 per year for a family of four), high unemployment and underemployment, poor housing, and comprised of people mostly belonging to one racial or ethnic minority.

2. Individualized instruction: lesson which allows the student to work at his own pace, provides for active learner involvement with the lesson, and provides feedback on his performance.

3. Individualized booklet: individualized instruction in pamphlet format.

4. Computer-assisted instruction (CAI): instruction in which the student interacts at his own pace with a lesson presented by computer in such a way that the computer can diagnose student errors, provide immediate feedback, provide drill and practice, store student data, and serve as text, test and tutor.

5. PLATO: an acronym for "programmed logic for automatic teaching operation" ("PLATO," c. 1973). It is a CAI system developed at the University of Illinois in Urbana; it is used in this study.

6. Social Science 102: second course on the fundamentals of social science. According to the Kennedy-King College Catalog 74/75, it covers "economic problems of complex society and the problems of the social organization of government" (p. 156). It offers three credit hours.

7. Achievement score: points given to represent the percent correct on a test.

## V. Limitations of the Study

1. The results of this study may not be easily generalized to other inner-city community colleges because there was no selection of students from the general population of inner-city community colleges.

2. Students were not selected from all Social Science 102 classes because of the few sections of the course being offered when the study was conducted (summer session 1975) and because of the potential difficulty in obtaining agreement by instructors to use the lesson.

## VI. Basic Assumptions

1. The students in the two groups that were studied were assumed to be homogenous in terms of intelligence and age.

2. Most of the students took the Social Science 102 course because it is required for the Associate of Arts degree.

VII. Procedures for Collecting Data

The investigator designed a PLATO lesson on "The Ideological Spectrum," a topic covered in a Social Science 102 course offered at Kennedy-King College. Lux Henniger, a Social Science 102 professor and chairman of the Department, was recruited to participate in the experiment. Henniger revised an individualized booklet he had designed on the topic. Both the investigator and the instructor consulted each other on the development of their lessons to make these similar in content, design, and length.

Both lessons followed a systematic design to instruction identified by Herrscher (1971, pp. 4-9). They contain a rationale to introduce the topic and explain or demonstrate its meaningfulness to the student; learning objectives to state what the expected outcomes of student behavior are; a pretest to determine if the student needs to complete the instruction; learning activities employing a variety of techniques and strategies; and a posttest to determine to what extent the student has achieved the learnig objectives; if he

does not demonstrate matery, the student is recycled through the instruction. Lesson revision is based on student performance.

Students in two Social Science 102 classes taught at Kennedy-King College during the summer session 1975 were randomly selected into two groups (A and B). Both groups received individualized instruction on "The Ideological Spectrum." Only the medium of instruction was different. Group A used the individualized booklet; Group B used PLATO.

During an in-class introductory session, 35 students took a pretest to determine how much they already knew on the topic. Should any student have passed the pretest, he would not have been required to take the instruction except for reading and completing out-of-class assignments. Students in Group A were presented a short introduction to the use of the individualized booklet. At the same time, the students in Group B were given a short introduction to the use of PLATO. The students had five days in which to complete all but the assignments section of the lesson on their own time. Eight students who had missed taking the pretest were given five days to complete the lesson on their own time. Forty-three students (20 in Group A; 23 in Group B) completed the posttest by the end of the one-week period.

Independent variable: medium of instruction

Dependent variable: achievement scores

## VIII. Procedures for Treating Data

The t-test for independent samples was applied to the posttest achievement scores of the two groups (individualized booklet and PLATO) to determine if there were a significant difference between the two groups. The desired level of significance was .05.

## IX. Results

### A. Data Resulting from the Study

No student passed the pretest, so all students were required to take the instruction and posttest (see Appendix A, p. for all test scores). The following is a frequency distribution of the posttest scores:

Table 1--Frequency Distribution of Posttest Scores for Two Groups Receiving Individualized Instruction

| Scores | Frequency | |
|---|---|---|
| | Individualized Booklet | PLATO |
| 96-100 | 0 | 1 |
| 91-95 | 4 | 4 |
| 86-90 | 5 | 2 |
| 81-85 | 1 | 5 |
| 76-80 | 0 | 5 |
| 71-75 | 1 | 1 |
| 66-70 | 2 | 0 |
| 61-65 | 1 | 3 |
| 56-60 | 0 | 2 |
| 51-55 | 1 | 0 |
| 46-50 | 2 | 0 |
| 41-45 | 1 | 0 |
| 36-40 | 1 | 0 |
| 31-35 | 0 | 0 |
| 26-30 | 0 | 0 |
| 21-25 | 0 | 0 |
| 16-20 | 1 | 0 |

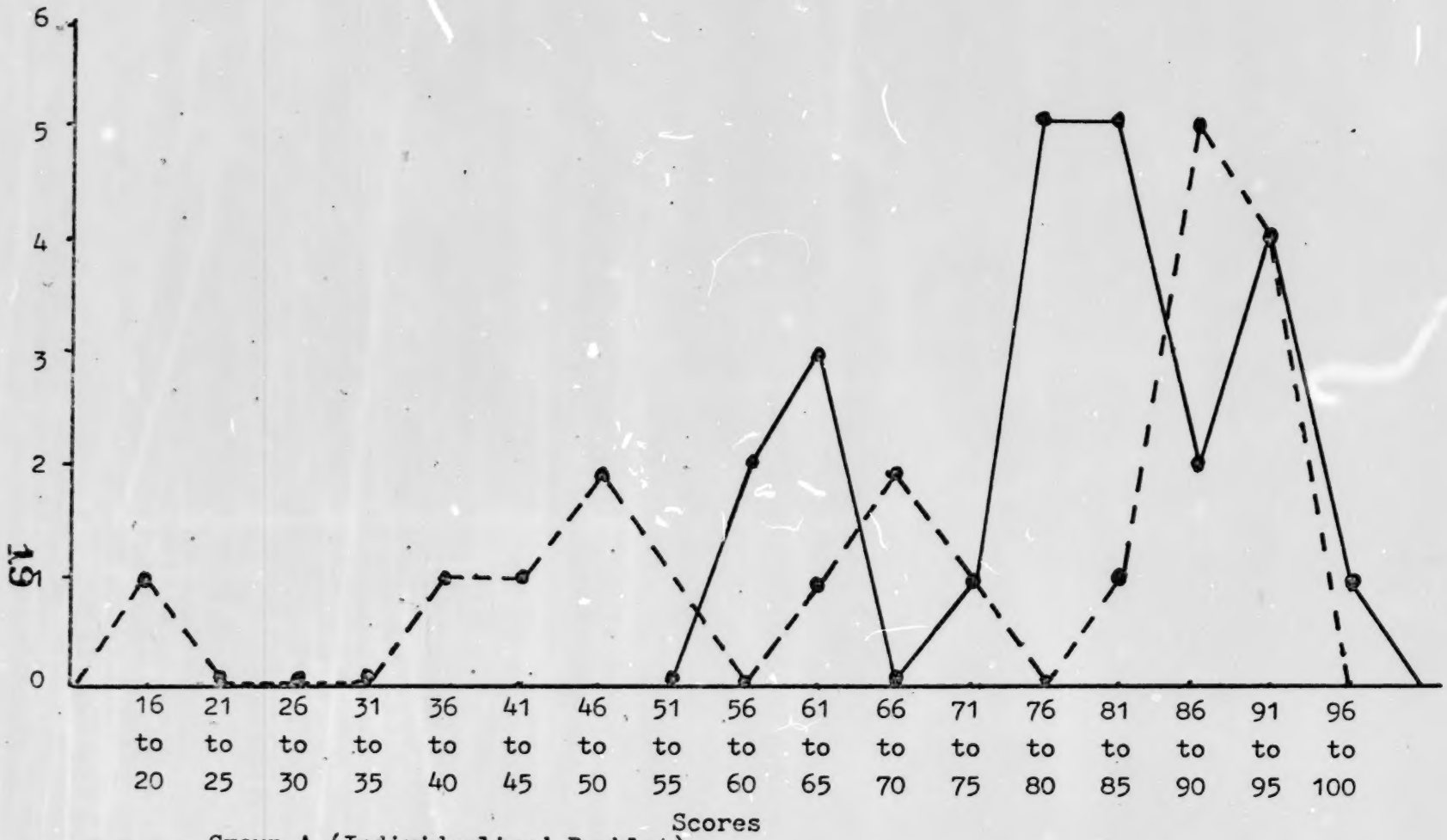


Fig. 1--Frequency Polygon of Posttest Scores for Two Groups Receiving Individualized Instruction

Group A (individualized booklet) had a mean achievement score of 71.0 and a median of 78 (raw scores used). Group B (PLATO) had a mean achievement score of 79.5 and a median of 81.

The range of the scores for the 20 students in Group A was from 19 to 94 and for the 23 students in Group B it was from 59 to 100. The standard deviation for Group A was 22.160 and for Group B it was 11.727. The difference in means between the two groups (A - B) was -8.478.

B. Significance of the Data

The t-test for independent samples was used. Since the assumption of equal variances was rejected ($p = 0.003$), p was estimated by Welch's method. The t-ratio ($t_{A-B}$) was -1.534. A t-ratio of 1.534 or larger could occur by chance with $p = 0.1432$. Thus, the null hypothesis that "there will be no significant difference in the mean achievement scores between students who have been instructed by individualized booklet and those who have been instructed by computer" could not be rejected at the .05 level of significance. There was a slight difference in the mean achievement scores in favor of Group B ($p = 0.1432$).

X. Conclusions and Significance

1. There may be a slight difference in the mean achievement scores between students who have been instructed by

individualized booklet and those who have been instructed by computer favoring the latter.

2. The six lowest scores were achieved by students in Group A (individualized booklet: 19, 38, 44, 47, 50 and 53). This may indicate that these students were less actively involved in the instructional process given by the booklet. Instruction by individualized booklet may demand less attentiveness than instruction by computer because it does not have as much depth in interaction.

3. The median achievement scores of both groups--79 for Group A and 81 for Group B--reflect higher achievement levels than is normally the case for students taking this unit of instruction in this instructor's Social Science 102 classes.

4. The instruction used was primarily drill and practice and should not be compared with simulations and tutorials.

5. The results found in this study may not be easily generalized to all students in Social Science 102 classes at Kennedy-King College, to all Kennedy-King College students, nor to other inner-city community colleges because of the limitations imposed by the selection process.

6. The lesson used in both instructional mediums should be revised on the basis of student data within the instruction and on student achievement on the posttest. Student opinions and professional opinions should also be sought.

Then the null hypothesis should be tested on the revised lesson.

7. New individualized instructional units should be developed for Social Science 102 either in booklet format or on PLATO. For variety, perhaps some lesson should be developed in each medium. It is not advisable to use both mediums for the same lessons because of the time involved.

## XI. Auxilliary Results

### A. Pretest Scores

The mean achievement on the pretest of the 14 students in Group A who took the pretest was 20.714 with a standard deviation of 11.411. The mean achievement on the pretest of the 21 students in Group B who took the pretest was 18.571 with a standard deviation of 15.260. The difference in means was 2.143.

A t-test was used to determine if there were no significant difference between the two groups in terms of previous learning on the topic of instruction. The assumption of equal variances was accepted (p=0.142). The t-ratio ($t_{A-B}$) was 0.448; a t this large or larger could occur by chance with p = 0.6573. There was no significant difference between the two groups in terms of previous learning.

### B. Student Attitude

Students in each group who completed the

instruction in the booklet or on PLATO were asked to indicate their preference to the question, "Did you enjoy this lesson" to help determine their attitude towards the instruction:

Table 2--Student Attitude Towards an Individualized unit on "The Ideological Spectrum"

| No. of Responses | | Question: "Did you enjoy this lesson?" |
|---|---|---|
| Group A | Group B | |
| 1 | 17 | one of the most enjoyable educational experiences I have had |
| 11 | 6 | quite enjoyable |
| 2 | 0 | neutral (so what?) |
| 2 | 0 | a rather negative experience |
| 0 | 0 | one of the least enjoyable educational experiences I have had |

| | N | mean | standard deviation |
|---|---|---|---|
| Group A | 16 | 3.688 | 0.793 |
| Group B | 23 | 4.739 | 0.449 |

The responses were weighted, 5 through 1 from most to least enjoyable. A t-test was used to determine if there was a significant difference between the mean responses of each group. The assumption of equal variances was rejected ($p=0.008$), hence p was estimated using Welch's method. The t-ratio ($t_{A-B}$) was -4.796. A t-ratio equal to 4.796 or larger could occur by chance with $p = 0.0001$. So there was a significant difference between the mean responses favoring Group B (PLATO). Observations of and discussions with students in Group B showed that

these students especially appreciated the presentation and explanation, immediate feedback, help and personalized reinforcement.

XII. Recommendations

1. Other Social Science instructors should be encouraged to review the individualized instructional units for their professional opinion and to have their students use either unit.

2. Another study should be completed during the fall semester 1975 on a revised instructional unit on "The Ideological Spectrum." More than two classes of students should be involved if possible.

3. Two hypotheses should be tested including the null hypotheses on the mean achievement scores and the mean attitudinal scores of both mediums of instruction.

4. Social Science instructors should be encouraged to develop additional individualized instruction. Both the investigator and the instructor who developed the individualized booklet have agreed to develop new units and to assist other Social Science instructors in the development of new units. Indeed, the instructor who developed the individualized booklet has decided to develop a series of units covering the entire Social Science 102 course and thus develop an individualized learning course (Magidson, July 1975). Another instructor in the Social Science

Department has already reviewed portions of the PLATO lesson. Several of his suggestions are being incorporated into both lessons. He has indicated a desire to have his students use the revised PLATO lesson.

5. The investigator will endeavor to teach a graduate course on "Designing Individualized Learning Modules" to interested faculty of the City Colleges of Chicago. He will seek a cooperating institution such as Governor's State University which might offer credit for the course. He will discuss possible arrangements with the Central Administration of the City Colleges to encourage such a course offering. The Central Administration could provide classroom facilities, distribute announcements, and grant credit towards lane placement to faculty successfully completing such a course.

Appendix A: Achievement Scores of Participants In Group A (Individualized Booklet)

| Student | Pretest | Posttest |
|---|---|---|
| 1 | 30 | 81 |
| 2 | 20 | 19 |
| 3 | 30 | 94 |
| 4 | 30 | 92 |
| 5 | 10 | 88 |
| 6 | 10 | 44 |
| 7 | 30 | 89 |
| 8 | 10 | 88 |
| 9 | 40 | 91 |
| 10 | 20 | 75 |
| 11 | 30 | 91 |
| 12 | 10 | 63 |
| 13 | 0 | 53 |
| 14 | 20 | 50 |
| 15 | | 70 |
| 16 | | 38 |
| 17 | | 88 |
| 18 | | 89 |
| 19 | | 70 |
| 20 | | 47 |
| | $\Sigma x = 290$ | $\Sigma x = 1420$ |
| | $N = 14$ | $N = 20$ |
| | mean = 20.714 | mean = 71.0 |
| | median = 20.0 | median = 78.0 |
| | range = 0 to 40 | range = 19 to 94 |
| | s.d. = 11.411 | s.d. = 22.160 |

Appendix B: Achievement Scores of Participants In Group B (PLATO)

| Student | Pretest | Posttest |
|---|---|---|
| 1 | 10 | 91 |
| 2 | 10 | 91 |
| 3 | 0 | 84 |
| 4 | 20 | 63 |
| 5 | 10 | 59 |
| 6 | 30 | 59 |
| 7 | 0 | 78 |
| 8 | 10 | 75 |
| 9 | 0 | 94 |
| 10 | 20 | 81 |
| 11 | 30 | 61 |
| 12 | 20 | 81 |
| 13 | 40 | 80 |
| 14 | 40 | 94 |
| 15 | 40 | 86 |
| 16 | 40 | 100 |
| 17 | 20 | 88 |
| 18 | 40 | 80 |
| 19 | 10 | 84 |
| 20 | 0 | 81 |
| 21 | 0 | 63 |
| 22 | | 77 |
| 23 | | 78 |
| | $\Sigma x$ = 390 | $\Sigma x$ = 1828 |
| | N = 21 | N = 23 |
| | mean = 18.571 | mean = 79.478 |
| | median = 20.0 | median = 81.0 |
| | range = 0 to 40 | range = 59 to 100 |
| | s.d. = 15.260 | s.d. = 11.727 |

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